

REMARKS

Claims 13, 16-23, 25, 26, 29-35 and 37-43 are currently pending in this application. Claims 13, 16-23, 25, 31, 32, 35, 37, 39, 40, 42 and 43 have been amended. No new matter has been added to this application.

Rejection of Claims 13, 16-23, 25, 26, 29-35 and 37-43 under 35 U.S.C. § 112

The Examiner has rejected claims 13, 16-23, 25, 26, 29-35 and 37-43 under 35 U.S.C. § 112, second paragraph, as being indefinite. Applicants respectfully traverse the rejection.

Applicants have amended claims 13, 16-23, 25, 31, 32, 35, 37, 39, 40, 42 and 43 to correct any inconsistencies in the claim language and to more clearly describe Applicants' invention. Claims 26, 29, 30, 33, 34, 38 and 41 being dependent upon independent claims 16 and 23 are believed to be definite. Applicants respectfully submit that claims 13, 16 and 23, as amended, correct any prior indefiniteness and request that the rejection of the claims under 35 U.S.C. § 112, second paragraph be withdrawn.

Rejection of Claims 13, 16-20, 23, 25, 26, 29, 30, 35, 37, 39, 40, 41, 42 and 43 under 35 U.S.C. § 102(b)

The Examiner has rejected claims 13, 16-20, 23, 25, 26, 30, 35, 37, 39, 40, 41, 42 and 43 under 35 U.S.C. § 102(b) as being anticipated by Applicants' admission of prior art. The Examiner contends that Applicants discuss the use of several types of graphical markers in the augmented reality display to allow a user to align the actual instrument with the path needed to be taken to place the instrument onto the actual target. The Examiner explicitly refers to pages 1-5 and page 34, line 16 to page 36, line 8. Applicants respectfully submit that the Examiner's characterization of the prior art disclosed by Applicants is factually incorrect.

Pages 1-5 of Applicants' specification provide a general description of augmented reality. One of the problems described in the background is when graphical virtual objects occlude a portion of the real scene. The present invention is directed to a graphical instrument guide that can be used to align a real instrument with a real target point without totally occluding the real view of the real instrument when it is properly aligned. The background does not teach or disclose such an approach.

With respect to the Examiner's characterization of the specification on page 34, line 16 to page 36, line 8 as a prior art description, Applicants' respectfully submit that such characterization is incorrect. While it is true that a prior art approach is discussed on page 35, lines 12-20 and page 35, lines 26 to page 36, line 2, the rest of the description in the passage cited by the Examiner is directed to Applicants' invention and not the prior art. Applicants are merely comparing the prior art approach (i.e., the fluoro-guided medical procedure) with the present invention (i.e., the augmented reality medical procedure).

Applicants disclose the known use of a bull's eye alignment method in fluoro-guided medical procedures (i.e., X-ray procedures) in which X-rays are used to check the alignment between an instrument and a target. While this procedure is effective, the exposure of a patient and physician to excessive radiation is not desirable. Applicants' invention is a solution to the use of X-rays for instruments positioning. Applicants' invention is directed to the use of virtual graphical markers or "virtual X-ray vision" as referred to by Applicant on page 35, lines 20-26. The prior art solution (X-ray procedures) does not use augmented reality to position an instrument. As such, Applicants' respectfully submit that the prior art cited by Applicants does not teach or disclose Applicants' invention as claimed and request that the rejection of claims 16-20, 23, 25, 26, 30, 35, 37, 39, 40, 41, 42 and 43 under 35 U.S.C. § 102(b) be withdrawn.

Applicants' claim 13 is directed to an instrument positioning method in which a graphical virtual guide is designed as a frame along the path, and

ultimately frames the actual instrument when it is correctly aligned. The path has an opening along its length so that when the actual instrument is properly aligned with the virtual guide, the instrument is not completely obscured by the guide. Such an approach is neither taught nor disclosed by the prior art addressed in Applicants' specification. Applicants respectfully request that the rejection of claim 13 under 35 U.S.C. § 102(b) be withdrawn.

Rejection of Claims 16, 22, 23, 31-35, 37 and 40-42 under 35 U.S.C. § 102(b)

The Examiner has rejected claims 16, 22, 23, 31-35, 37 and 40-42 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent Publication No. 2002/077540 (Kienzle). The Examiner contends that Kienzle discloses Applicants' invention as claimed. Applicants respectfully traverse the rejection.

The present invention is directed to a method for augmented reality guided instrument positioning. A target point is defined within a real object. A path to reach the target point within the real object is defined. A pose of a real instrument with respect to a pose of the real object is tracked. A graphical representation of the real instrument and the path is rendered to obtain a virtual instrument and a graphical virtual guide on a display. . The graphical representation is rendered with respect to a virtual viewpoint from which a virtual line of sight coincides with a virtual path for the virtual instrument to follow during a positioning of the real instrument to the target point. The virtual guide corresponds to the path. The virtual instrument comprises a 3D structure for line of sight alignment. The 3D structure comprises a plurality of markers centered on and distributed along an axis of the virtual instrument;

The virtual instrument is aligned along the virtual line of sight according to the virtual guide in order to accordingly align the real instrument along the path. The real instrument is moved by a user in response to viewing the virtual instrument and the virtual guide on the display. The real instrument moves along the path towards the real target point keeping the correct alignment by observing

and keeping in alignment with the virtual instrument and virtual guide. The user needs to keep the alignment intact while inserting the real instrument into the real object toward the target point. Claim 23 introduces tracking of the real instrument. In this case, position and orientation of the real instrument with respect to the real object and the path are known, and the user does not need an augmented reality view that comprises a view of the real instrument to perform correct alignment. Alignment can now be performed based on a graphical virtual representation of both instrument and path.

Kienzle discloses a computer assisted surgery system which uses graphic representations that are displayed overlaid onto X-ray images. Kienzle discloses a standard navigation system in which the location of the tracked instrument is superimposed as a virtual model onto a medical image. Correct alignment is achieved by looking at the position of the instrument's virtual model in the medical image. In Kienzle, using a tracking system to track the position of the actual instrument is an essential part of the navigation process.

In the present invention, there is no need to track the actual instrument (except claim 23, which uses tracking in combination with the specific line-of-sight method). A user sees a real view of the real instrument and a real patient. These real images are augmented with graphical information that allows the user to perceive planned paths for instrument guidance. Correct alignment is performed by looking at the augmented reality image and seeing the position of the real instrument in relation to the graphical guides. Applicants respectfully submit that Kienzle does not teach using augmented reality for guided instrument positioning. Kienzle merely teaches using a virtual feature to identify landmark points in the body of a patient. As such, Kienzle does not teach or disclose Applicants' invention as claimed. Applicants respectfully request that the rejection of claims 16, 22, 23, 31-35, 37 and 40-42 under 35 U.S.C. § 102(b) be withdrawn.

Rejection of Claim 21 under 35 U.S.C. § 103(a)

The Examiner has rejected claim 21 under 35 U.S.C. § 103(a) as being unpatentable over Kienzle in view of Applicants' admitted prior art. The Examiner correctly notes that Kienzle does not teach or disclose a graphical axis marker that comprises an intersection of at least two lines that is centered on the axis of the actual instrument for correct alignment. The Examiner contends that Applicants' admitted prior art teaches uses gun aiming and argues that it would have been obvious to one skilled in the art to apply it to augmented reality aiming of real instruments. Applicants respectfully traverse the rejection.

Applicants respectfully submit that the combination of Kienzle and the prior art cited by Applicants does not teach or disclose Applicants' invention as claimed. Neither Kienzle nor the prior art teach or disclose an augmented reality method for positioning an instrument in which the steps of "aligning the user's augmented reality line-of-sight with the at least one graphical axis marker so that the path to reach said target point with the real instrument is aligned along the augmented reality line-of-sight" and "aligning the real instrument to the path by aligning the real instrument with the augmented reality line-of-sight towards the target point;" as recited in amended independent claim 16. Claim 21 being dependent upon independent claim 16 is also not taught or disclosed by the combination of Kienzle and the prior art. Applicants respectfully request that the rejection of claim 21 under 35 U.S.C. § 103(a) be withdrawn.

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Reply to Office Action of March 12, 2007

Conclusion

Applicants respectfully submit that claims 13, 16-23, 25, 26, 29-35 and 37-43, as amended, are in condition for allowance and request that a timely Notice of Allowance be issued in this case. The Examiner is invited to contact the undersigned should he have any questions in this matter.

Respectfully submitted,

A handwritten signature in blue ink that reads "Michele L. Conover". The signature is written in a cursive style with a large, stylized "M" and "C".

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